Mate limitation, recurrent epidemic outbreaks, and the coexistence of sexual and asexual plant parasites

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To date, relatively few studies have focused on the effects of sex on population dynamics. Previous models found that sexual reproduction may either dampen population fluctuations or accentuate population fluctuations, depending on mating system notably. Here we were interested in the effect of mate limitation in pathogens in which both sexual and asexual reproductions occur simultaneously within direct life cycles, a life history typical of many fungal plant pathogens for instance. We modelled the epidemiological dynamics of such species by considering a SIR model with two modes of transmission, one linear and the other bilinear in infected density. We found that the threshold for epidemic development is the same as expected under strictly asexual dynamics. We showed that sexual spore production promotes more complex dynamics (cycles) than strictly asexual reproduction. We further showed that sexual reproduction has important consequences for the coexistence of parasites infecting the same host: in parameter ranges where the parasite population dynamics fluctuate, the stable coexistence of parasites on the same host is possible, whereas it is not in the asexual case. We discuss the implications of these results for understanding complex epidemiological dynamics and point to some consequences for epidemics management.